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DATA SHEET

TDA1010A

6 W audio power amplifier in car applications

10 W audio power amplifier in mains-fed applications

Product specification
File under Integrated Circuits, IC01

November 1982

Philips Semiconductors

PHILIPS

6 W audio power amplifier in car applications
10 W audio power amplifier in mains-fed

TDA1010A

The TDA1010A is a monolithic integrated class-B audio amplifier circuit in a 9-lead single in-line (SIL) plastic package. The device is primarily developed as a 6 W car radio amplifier for use with 4 Ω and 2 Ω load impedances. The wide supply voltage range and the flexibility of the IC make it an attractive proposition for record players and tape recorders with output powers up to 10 W.

Special features are:

- single in-line (SIL) construction for easy mounting
- separated preamplifier and power amplifier
- high output power
- low-cost external components
- good ripple rejection
- thermal protection

QUICK REFERENCE DATA

Supply voltage range	V_P		6 to 24	V
Repetitive peak output current	I_{ORM}	max.	3	A
Output power at pin 2; d_{tot} = 10%				
V_P = 14,4 V; R_L = 2 Ω	P_o	typ.	6,4	W
V_P = 14,4 V; R_L = 4 Ω	P_o	typ.	6,2	W
V_P = 14,4 V; R_L = 8 Ω	P_o	typ.	3,4	W
V_P = 14,4 V; R_L = 2 Ω; with additional bootstrap resistor of 220 Ω between pins 3 and 4	P_o	typ.	9	W
Total harmonic distortion at P_o = 1 W; R_L = 4 Ω	d_{tot}	typ.	0,2	%
Input impedance				
preamplifier (pin 8)	$\lvert Z_i \rvert$	typ.	30	kΩ
power amplifier (pin 6)	$\lvert Z_i \rvert$	typ.	20	kΩ
Total quiescent current at V_P = 14,4 V	I_{tot}	typ.	31	mA
Sensitivity for P_o = 5,8 W; R_L = 4 Ω	V_i	typ.	10	mV
Operating ambient temperature	T_{amb}		–25 to + 150	°C
Storage temperature	T_{stg}		–55 to + 150	°C

PACKAGE OUTLINE

9-lead SIL; plastic (SOT110B); SOT110-1; 1996 Sepetember 06.

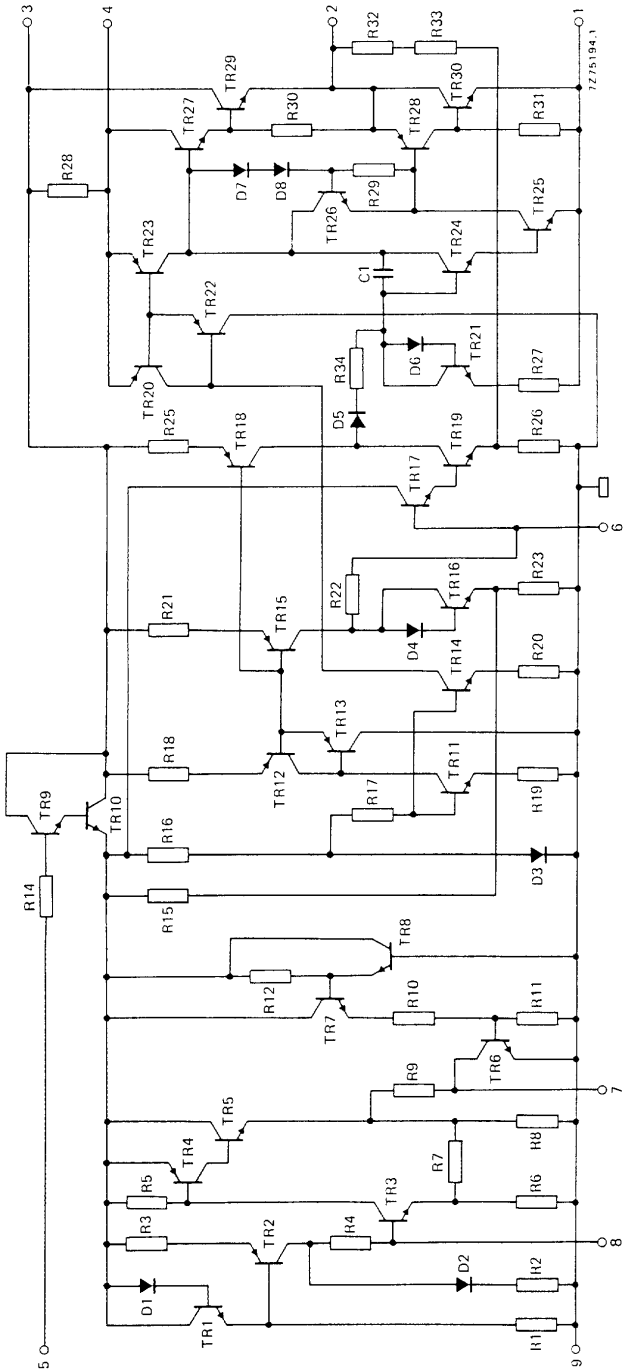


Fig.1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	V_P	max.	24	V
Peak output current	I_{OM}	max.	5	A
Repetitive peak output current	I_{ORM}	max.	3	A
Total power dissipation	see derating curve Fig.2			
Storage temperature	T_{stg}	–55 to +150		°C
Operating ambient temperature	T_{amb}	–25 to +150		°C
A.C. short-circuit duration of load during sine-wave drive; without heatsink at V_P = 14,4 V	t_{sc}	max.	100	hours

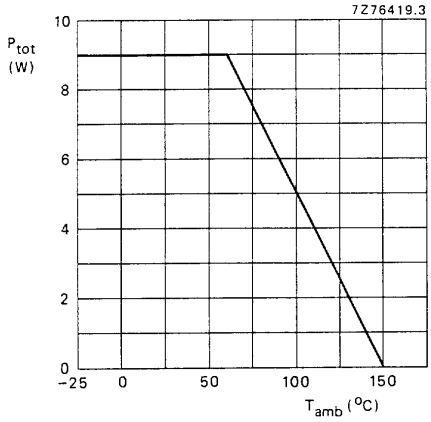


Fig.2 Power derating curve.

HEATSINK DESIGN

Assume V_P = 14,4 V; R_L = 2 Ω; T_{amb} = 60 °C maximum; thermal shut-down starts at T_j = 150 °C. The maximum sine-wave dissipation in a 2 Ω load is about 5,2 W. The maximum dissipation for music drive will be about 75% of the worst-case sine-wave dissipation, so this will be 3,9 W. Consequently, the total resistance from junction to ambient

$$R_{th\ j\text{-}a} = R_{th\ j\text{-}tab} + R_{th\ tab\text{-}h} + R_{th\ h\text{-}a} = \frac{150 - 60}{3,9} = 23\ \text{K/W}.$$

Since $R_{th\ j\text{-}tab}$ = 10 K/W and $R_{th\ tab\text{-}h}$ = 1 K/W,

$R_{th\ h\text{-}a}$ = 23 – (10 + 1) = 12 K/W.

D.C. CHARACTERISTICS

Supply voltage range	V_P		6 to 24	V
Repetitive peak output current	I_{ORM}	<	3	A
Total quiescent current at V_P = 14,4 V	I_{tot}	typ.	31	mA

A.C. CHARACTERISTICS

T_{amb} = 25 °C; V_P = 14,4 V; R_L = 4 Ω; f = 1 kHz unless otherwise specified; see also Fig.3.

A.F. output power (see Fig.4) at d_{tot} = 10%;				
measured at pin 2; with bootstrap				
V_P = 14,4 V; R_L = 2 Ω (note 1)	P_o	typ.	6,4	W
V_P = 14,4 V; R_L = 4 Ω (note 1 and 2)	P_o	>	5,9	W
		typ.	6,2	W
V_P = 14,4 V; R_L = 8 Ω (note 1)	P_o	typ.	3,4	W
V_P = 14,4 V; R_L = 4 Ω; without bootstrap	P_o	typ.	5,7	W
V_P = 14,4 V; R_L = 2 Ω; with additional bootstrap resistor of 220 Ω between pins 3 and 4	P_o	typ.	9	W
Voltage gain				
preamplifier (note 3)	G_{v1}	typ.	24	dB
			21 to 27	dB
power amplifier	G_{v2}	typ.	30	dB
			27 to 33	dB
total amplifier	$G_{v\,tot}$	typ.	54	dB
			51 to 57	dB
Total harmonic distortion at P_o = 1 W	d_{tot}	typ.	0,2	%
Efficiency at P_o = 6 W	η	typ.	75	%
Frequency response (–3 dB)	B		80 Hz to 15	kHz
Input impedance				
preamplifier (note 4)	$\lvert Z_i \rvert$	typ.	30	kΩ
			20 to 40	kΩ
power amplifier (note 5)	$\lvert Z_i \rvert$	typ.	20	kΩ
			14 to 26	kΩ
Output impedance of preamplifier; pin 7 (note 5)	$\lvert Z_o \rvert$	typ.	20	kΩ
			14 to 26	kΩ
Output voltage preamplifier (r.m.s. value)				
d_{tot} < 1% (pin 7) (note 3)	$V_{o(rms)}$	>	0,7	V
Noise output voltage (r.m.s. value; note 6)				
R_S = 0 Ω	$V_{n(rms)}$	typ.	0,3	mV
R_S = 8,2 kΩ	$V_{n(rms)}$	typ.	0,7	mV
		<	1,4	mV
Ripple rejection at f = 1 kHz to 10 kHz (note 7)	RR	>	42	dB
at f = 100 Hz; C2 = 1 μF	RR	>	37	dB
Sensitivity for P_o = 5,8 W	V_i	typ.	10	mV
Bootstrap current at onset of clipping; pin 4 (r.m.s. value)	$I_{4(rms)}$	typ.	30	mA

Notes

1. Measured with an ideal coupling capacitor to the speaker load.
2. Up to $P_o \leq 3$ W : $d_{tot} \leq 1\%$.
3. Measured with a load impedance of 20 kΩ.
4. Independent of load impedance of preamplifier.
5. Output impedance of preamplifier ($|Z_O|$) is correlated (within 10%) with the input impedance ($|Z_i|$) of the power amplifier.
6. Unweighted r.m.s. noise voltage measured at a bandwidth of 60 Hz to 15 kHz (12 dB/octave).
7. Ripple rejection measured with a source impedance between 0 and 2 kΩ (maximum ripple amplitude: 2 V).
8. The tab must be electrically floating or connected to the substrate (pin 9).

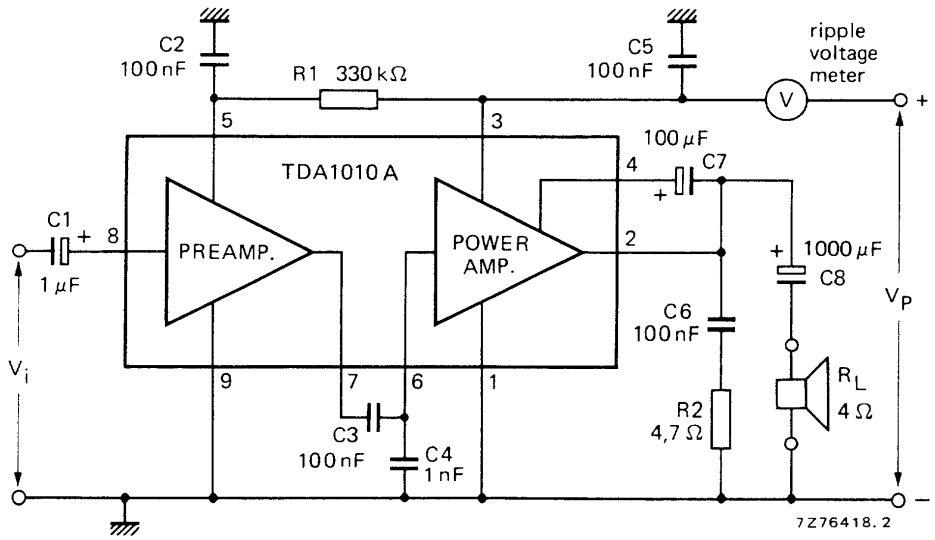


Fig.3 Test circuit.

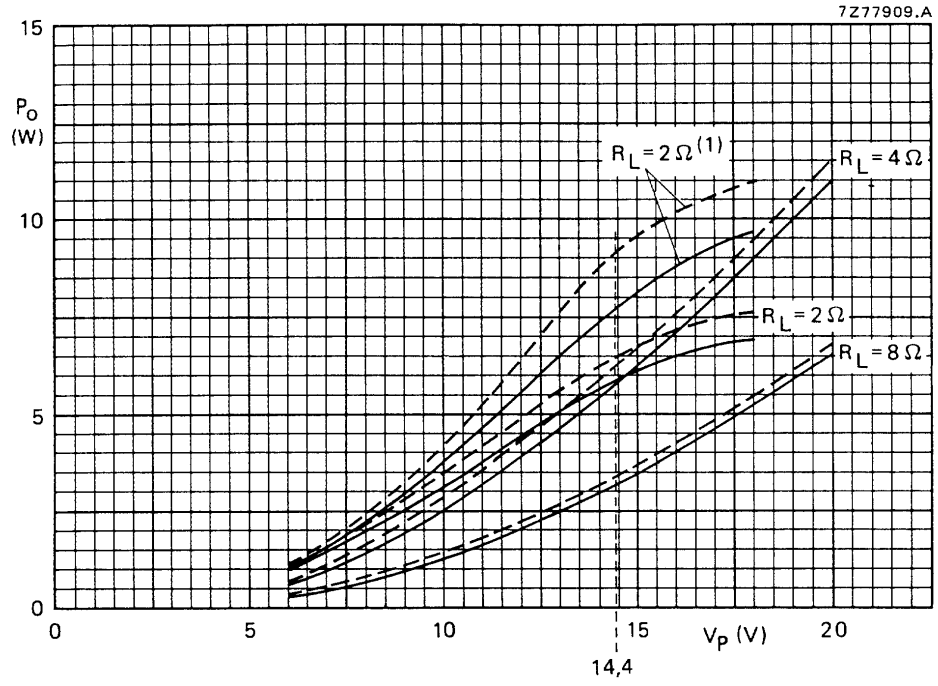


Fig.4 Output power of the circuit of Fig.3 as a function of the supply voltage with the load impedance as a parameter; typical values. Solid lines indicate the power across the load, dashed lines that available at pin 2 of the TDA1010. $R_L = 2\ \Omega$ (1) has been measured with an additional 220 Ω bootstrap resistor between pins 3 and 4. Measurements were made at f = 1 kHz, d_{tot} = 10%, T_{amb} = 25 °C.

Fig. 5 See next page.
Total harmonic distortion in the circuit of Fig.3 as a function of the output power with the load impedance as a parameter; typical values. Solid lines indicate the power across the load, dashed lines that available at pin 2 of the TDA1010. $R_L = 2\ \Omega$ (1) has been measured with an additional 220 Ω bootstrap resistor between pins 3 and 4. Measurements were made at f = 1 kHz, V_P = 14,4 V.

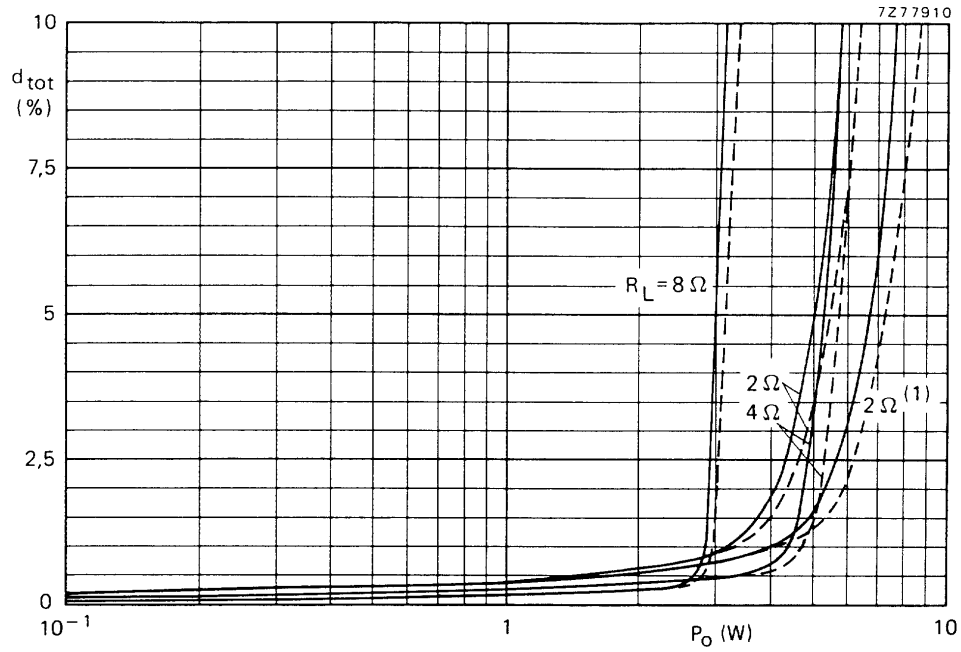


Fig.5 For caption see preceding page.

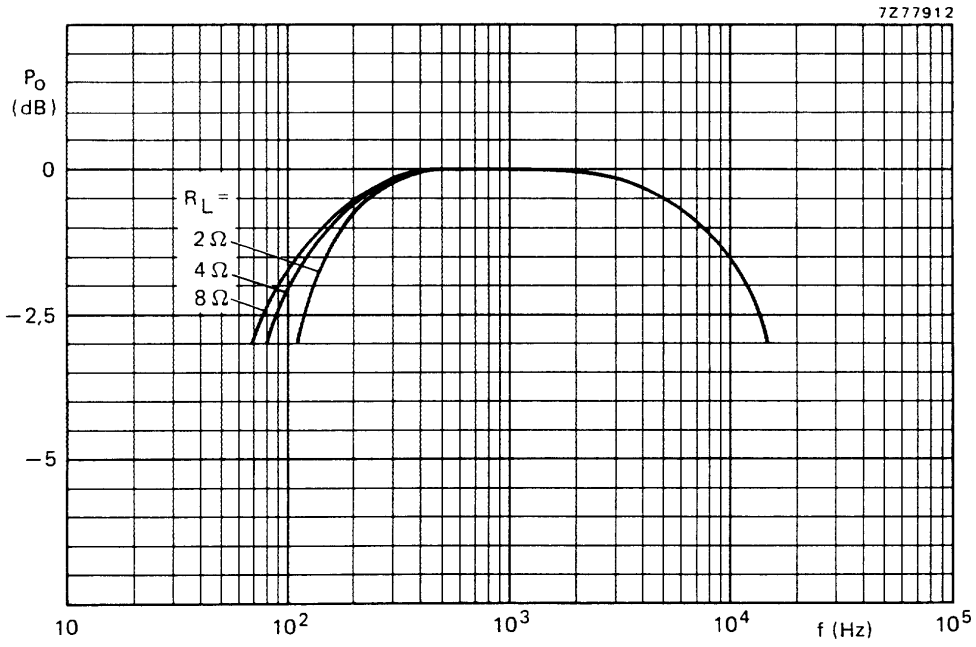


Fig.6 Frequency characteristics of the circuit of Fig.3 for three values of load impedance; typical values. P_o relative to 0 dB = 1 W; V_P = 14,4 V.

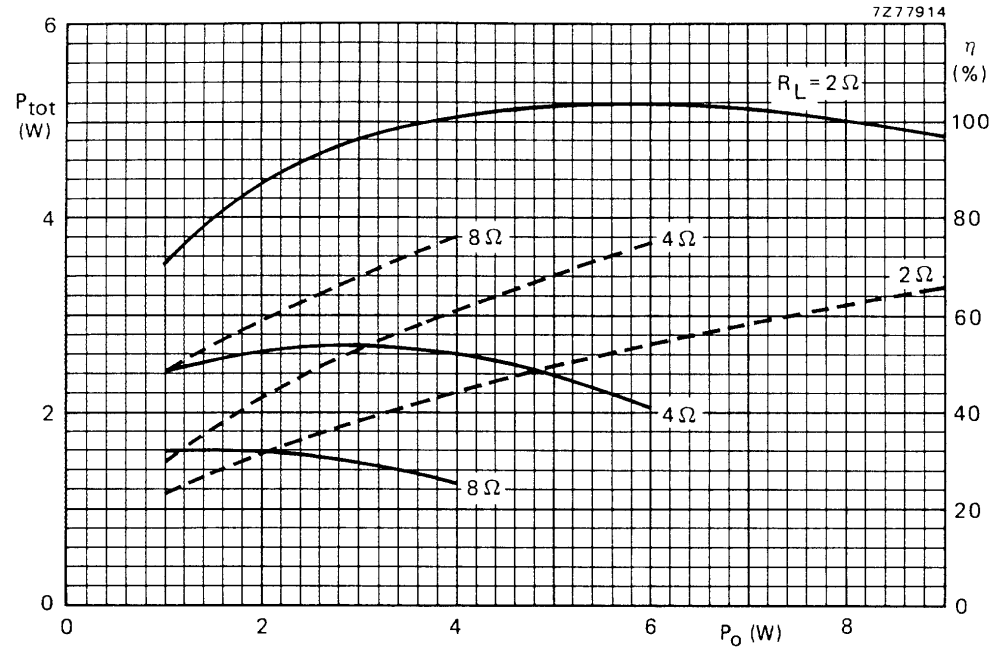


Fig.7 Total power dissipation (solid lines) and the efficiency (dashed lines) of the circuit of Fig.3 as a function of the output power with the load impedance as a parameter (for R_L = 2 Ω an external bootstrap resistor of 220 Ω has been used); typical values. V_P = 14,4 V; f = 1 kHz.

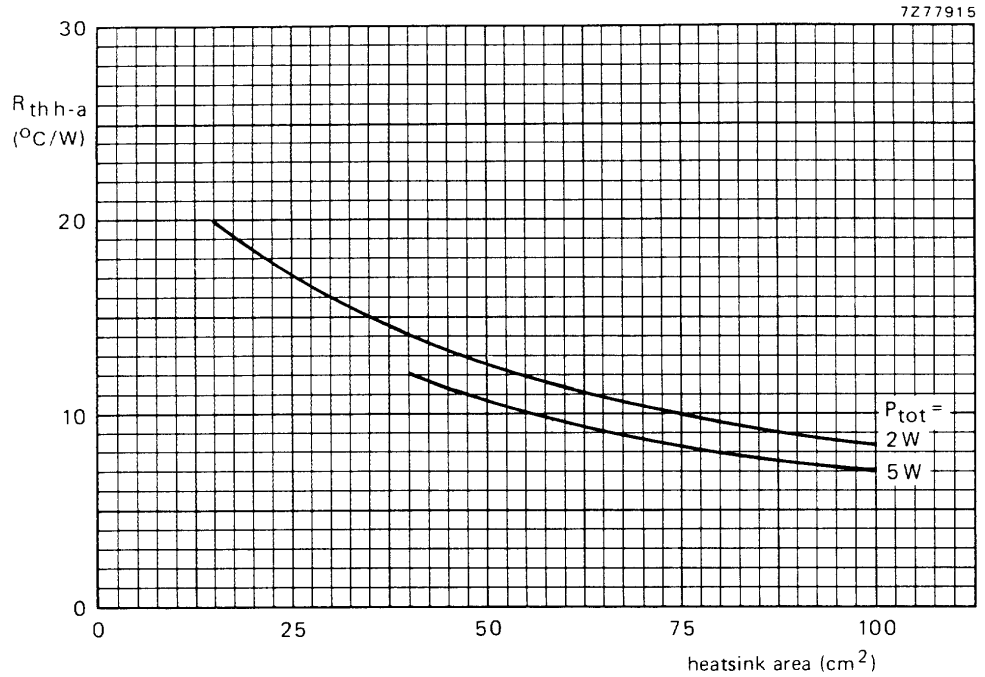


Fig.8 Thermal resistance from heatsink to ambient of a 1,5 mm thick bright aluminium heatsink as a function of the single-sided area of the heatsink with the total power dissipation as a parameter.

APPLICATION INFORMATION

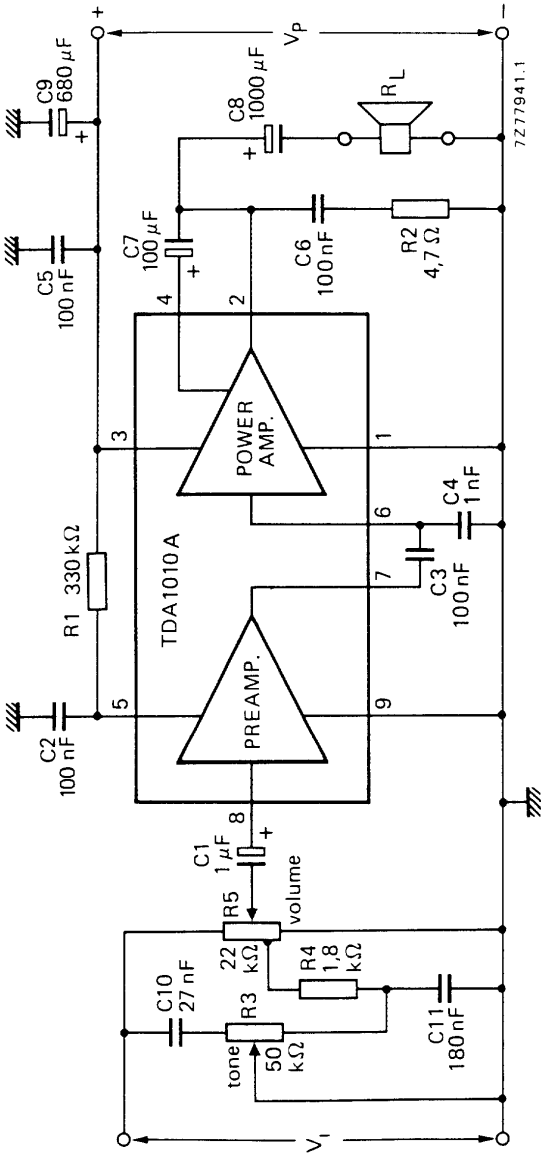


Fig.9 Complete mono audio amplifier of a car radio.

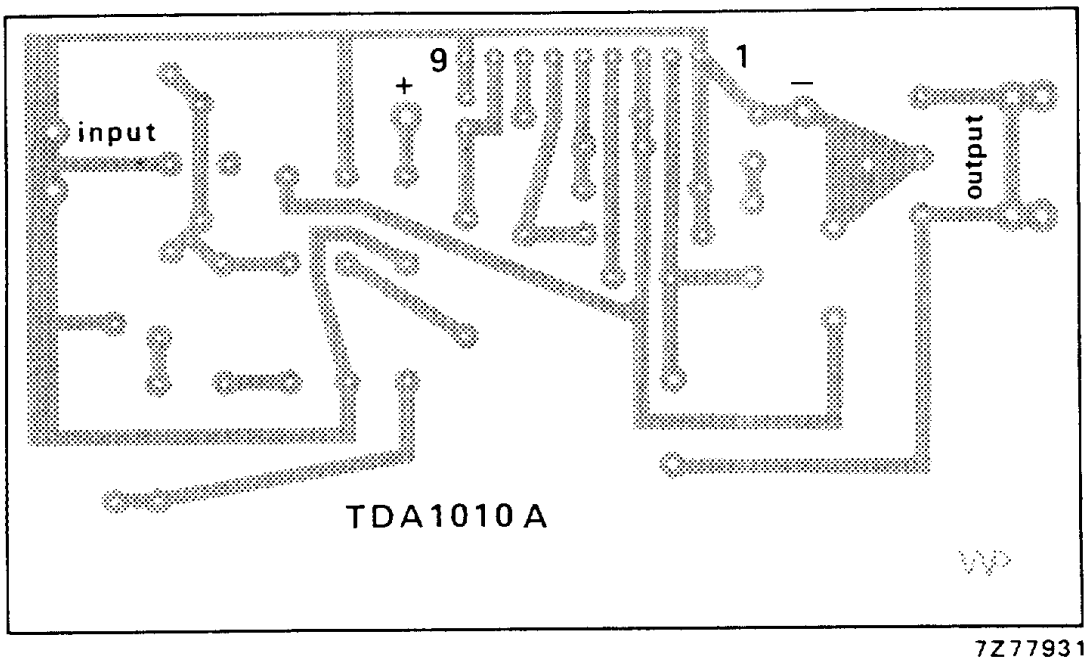


Fig.10 Track side of printed-circuit board used for the circuit of Fig.9; p.c. board dimensions 92 mm × 52 mm.

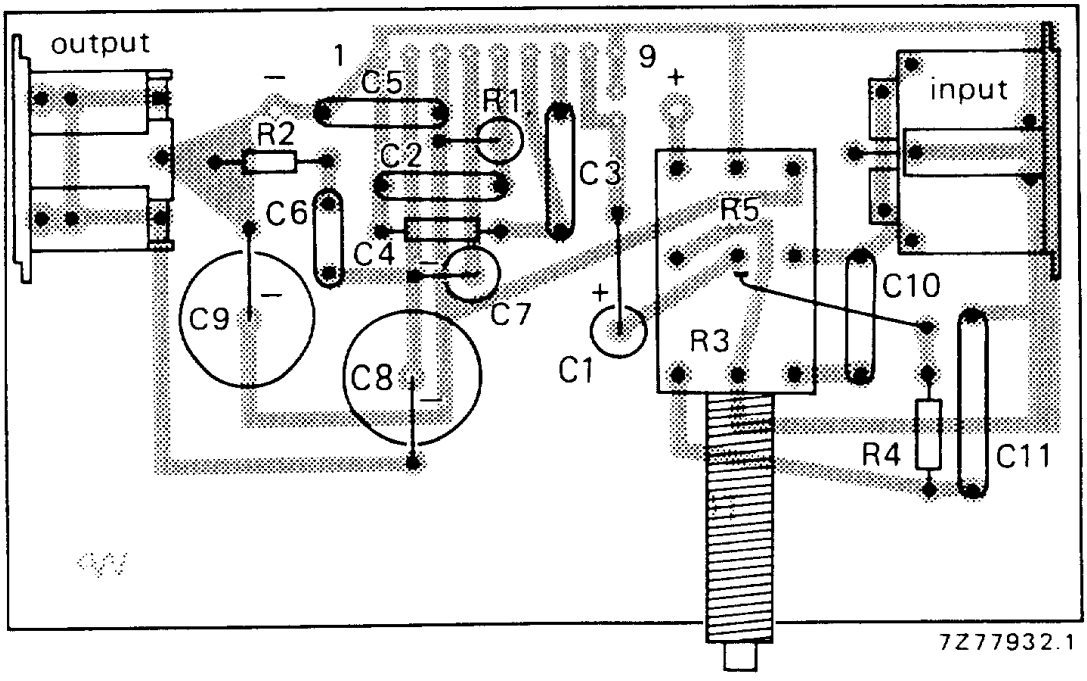


Fig.11 Component side of printed-circuit board showing component layout used for the circuit of Fig.9.

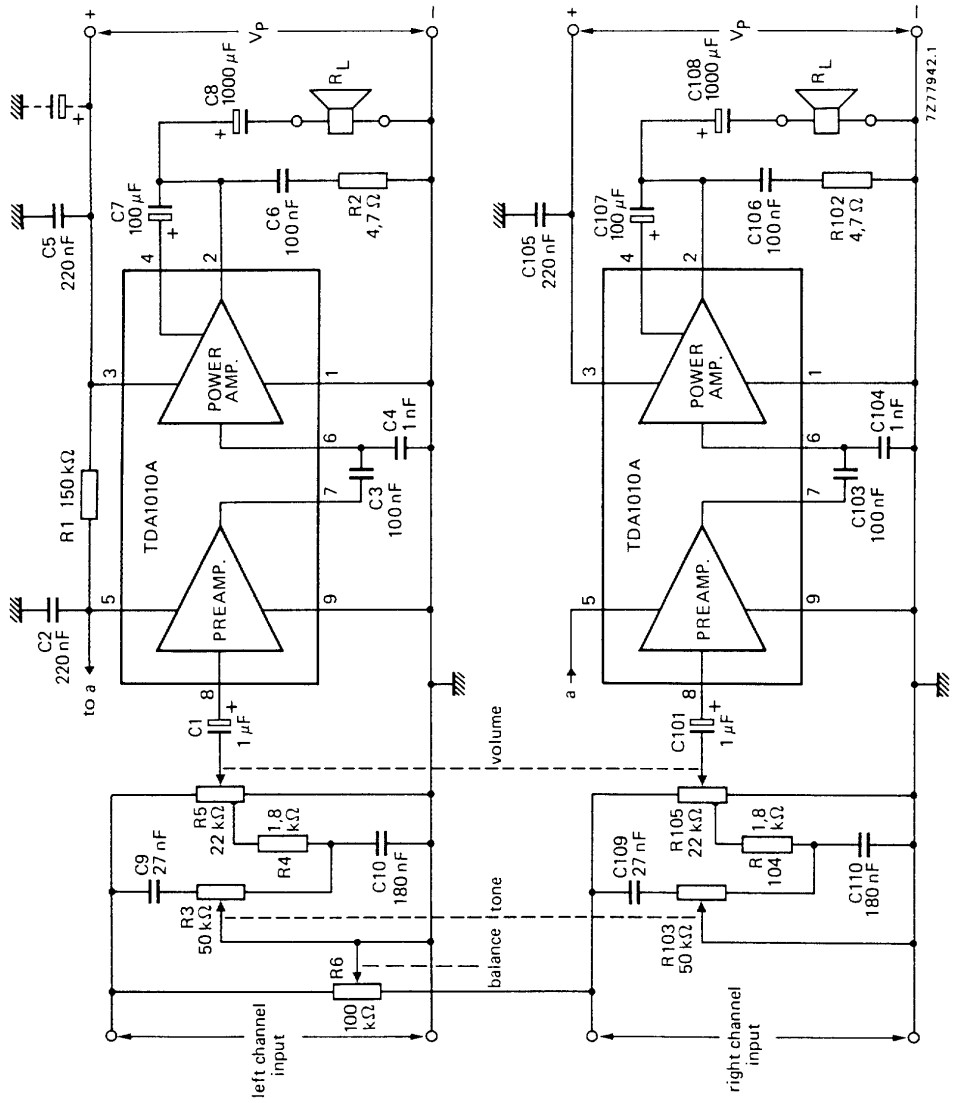


Fig.12 Complete stereo car radio amplifier.

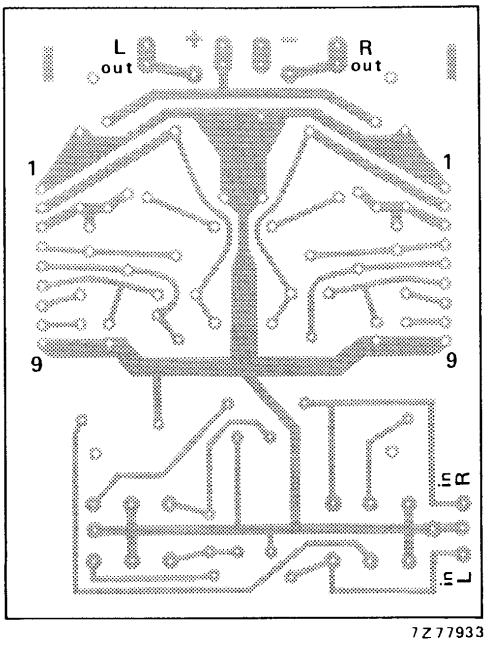


Fig.13 Track side of printed-circuit board used for the circuit of Fig.12; p.c. board dimensions 83 mm × 65 mm.

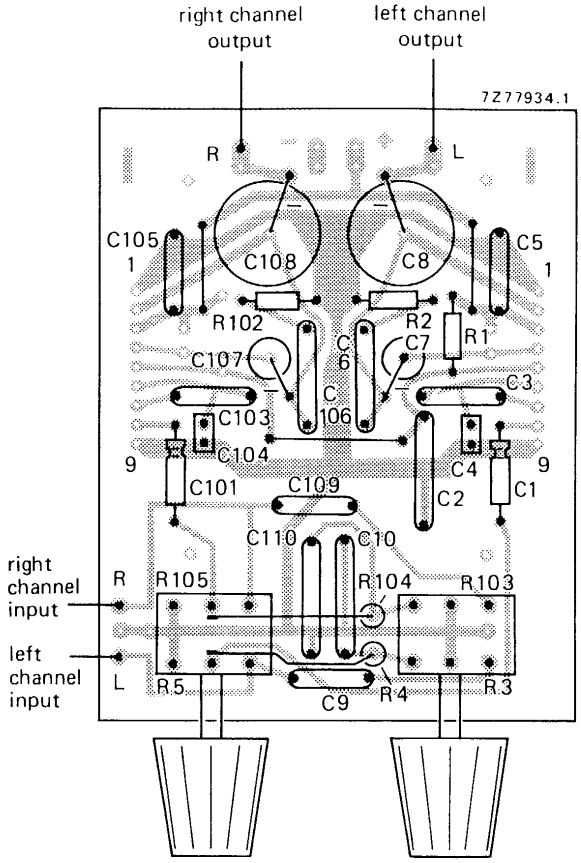


Fig.14 Component side of printed-circuit board showing component layout used for the circuit of Fig.12. Balance control is not on the p.c. board.

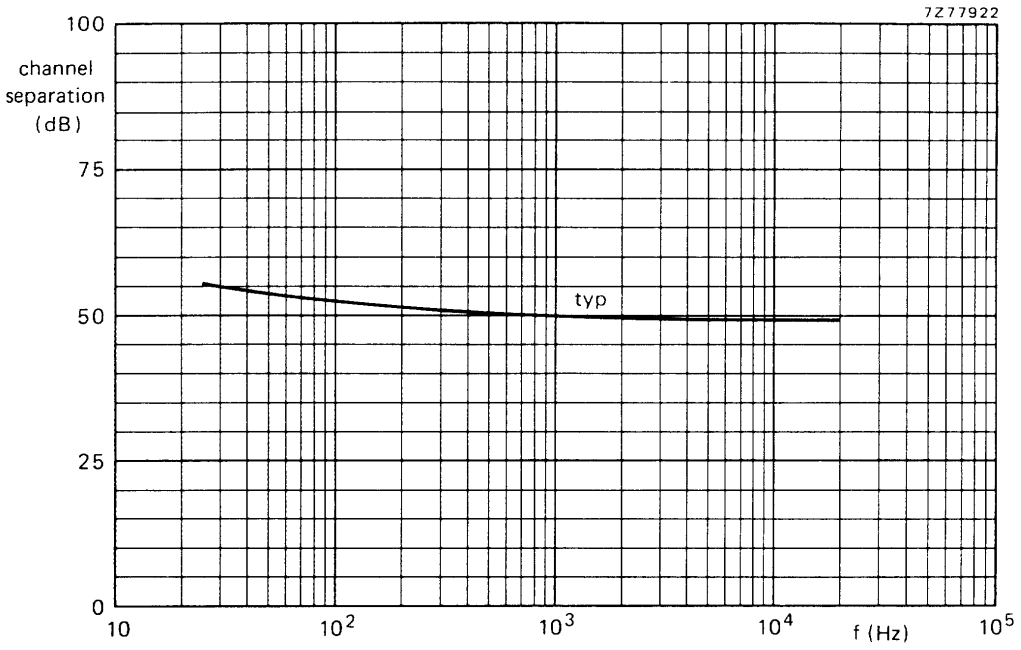


Fig.15 Channel separation of the circuit of Fig.12 as a function of the frequency.

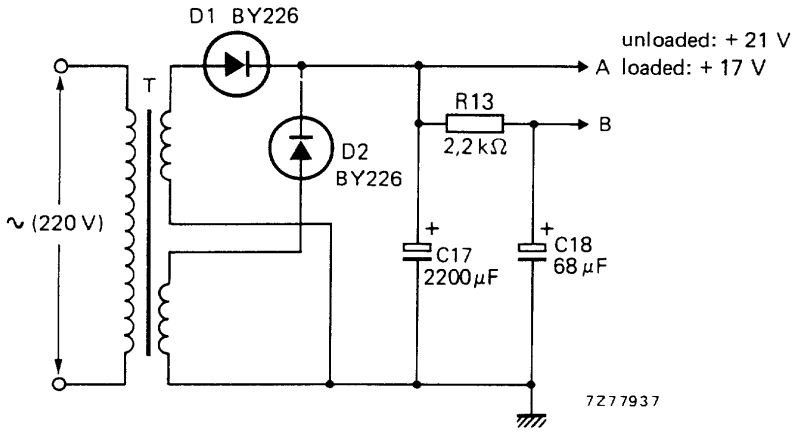


Fig.16 Power supply of circuit of Fig.17.

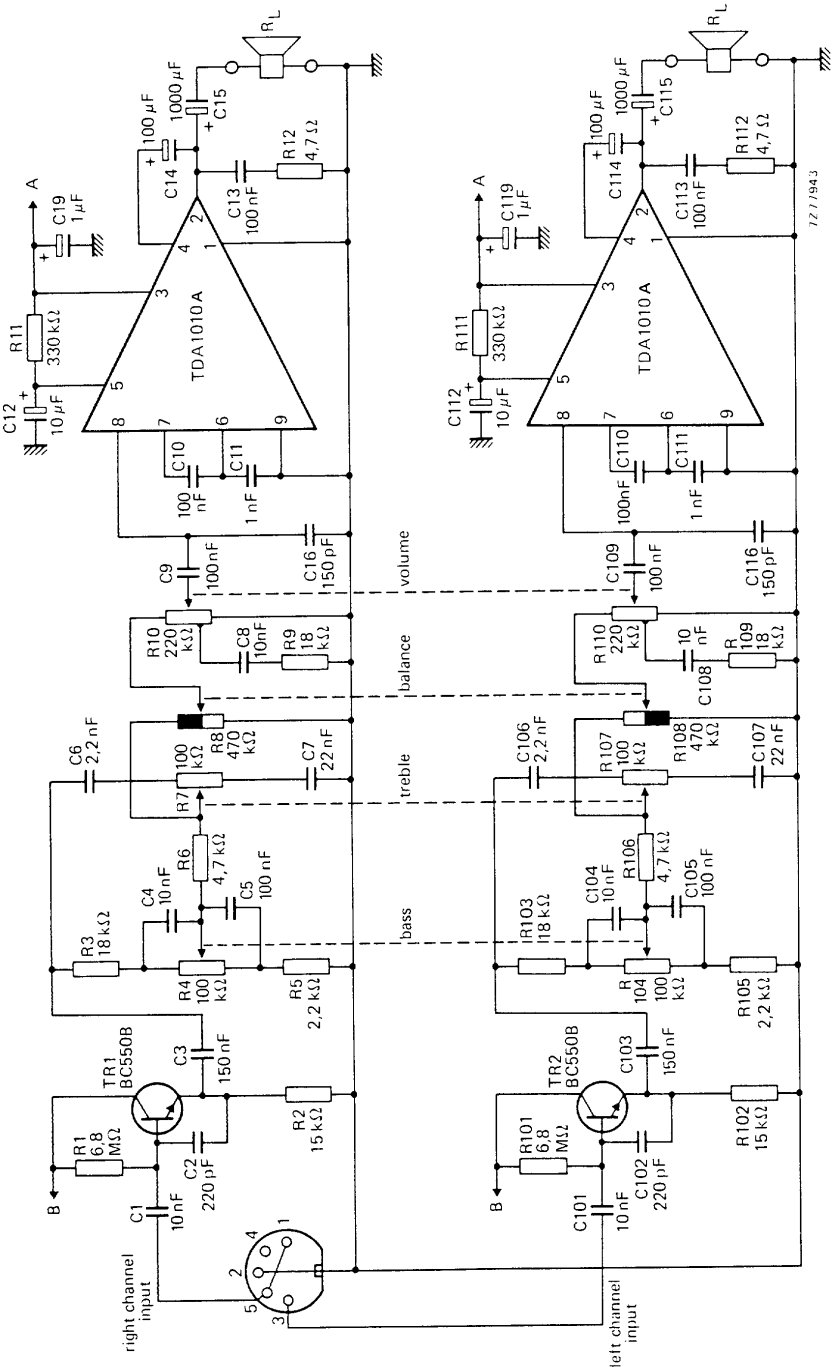


Fig.17 Complete mains-fed ceramic stereo pick-up amplifier; for power supply see Fig.16.

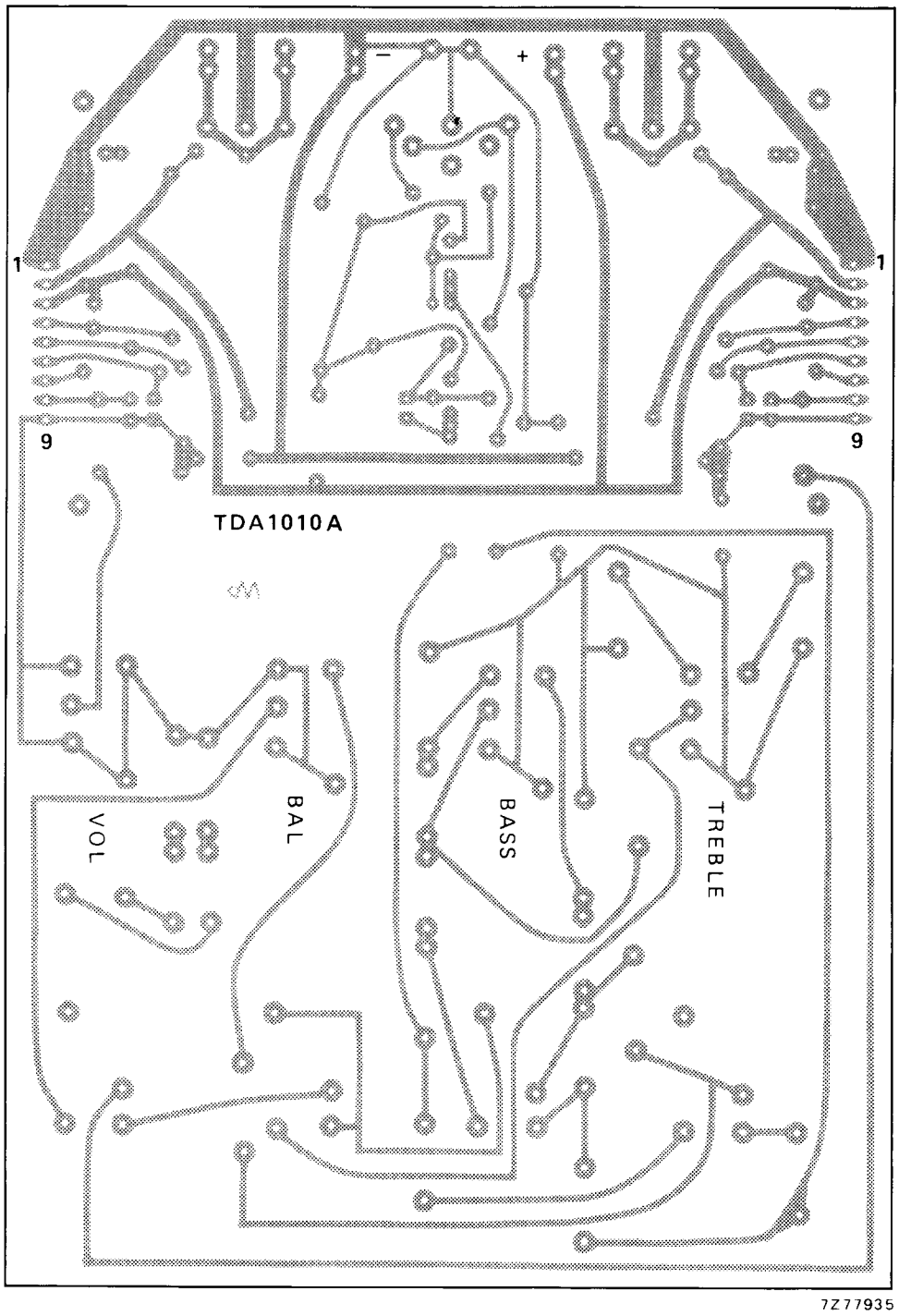


Fig.18 Track side of printed-circuit board used for the circuit of Fig.17 (Fig.16 partly); p.c. board dimensions 169 mm × 118 mm.

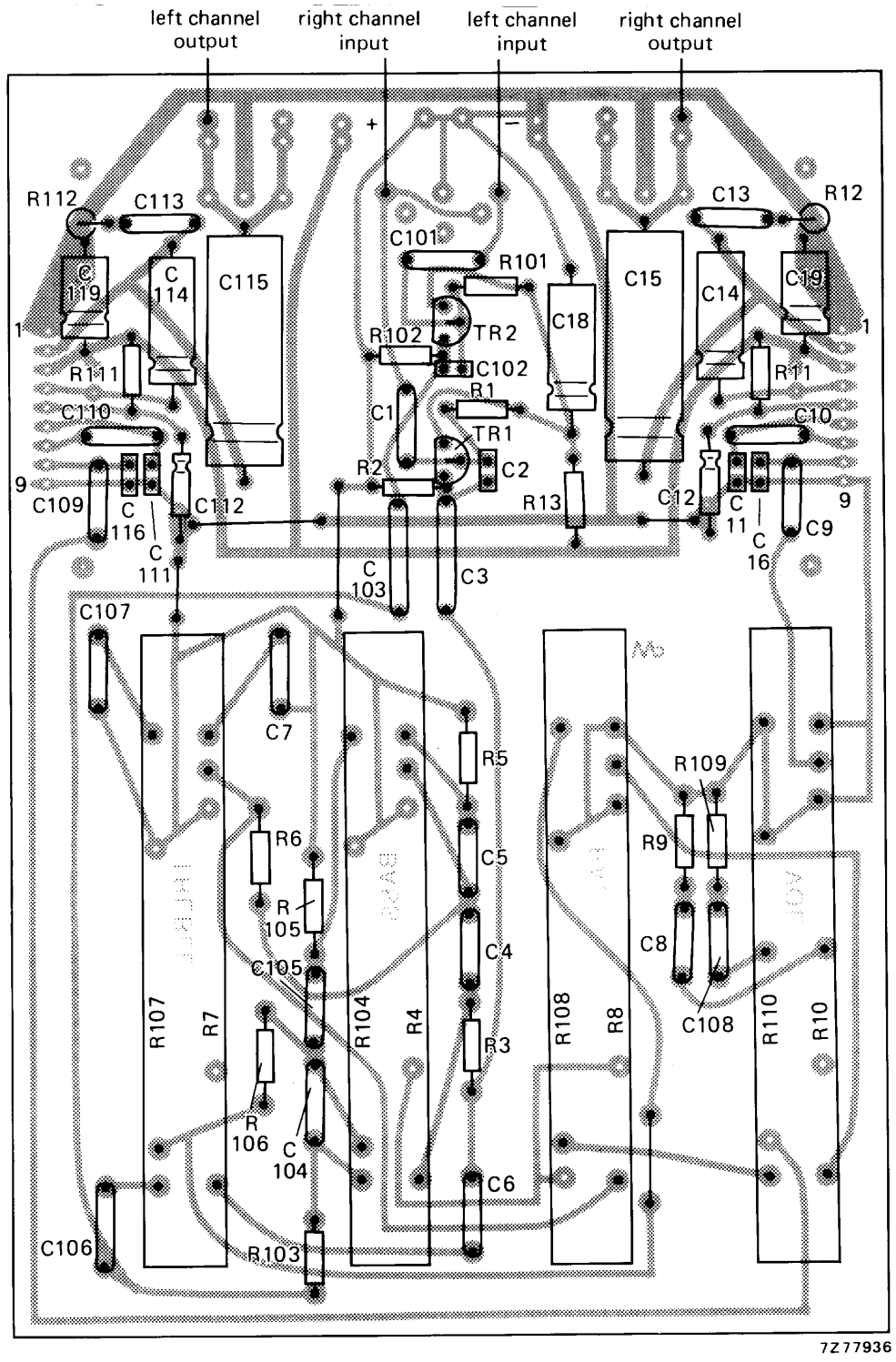
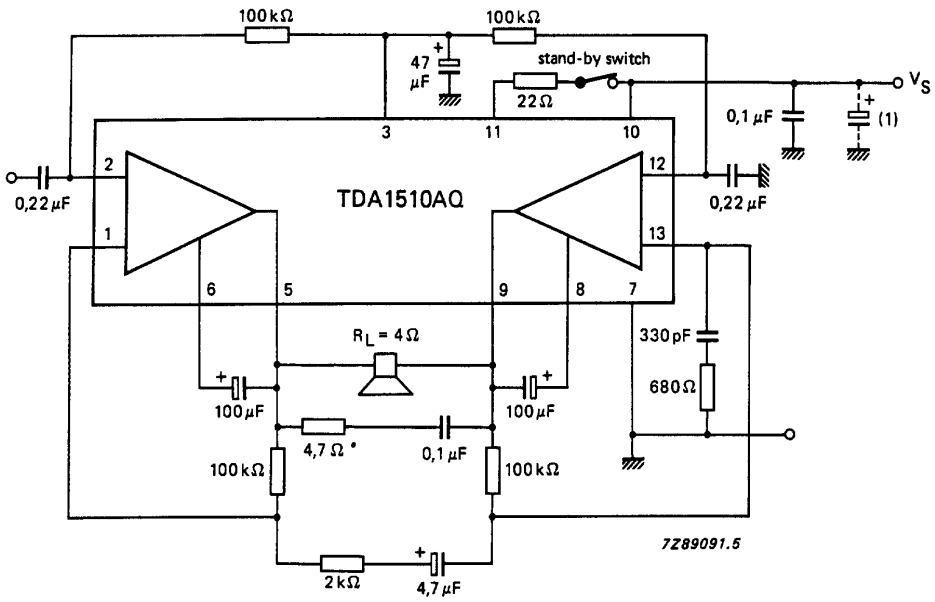


Fig.19 Component side of printed-circuit board showing component layout used for the circuit of Fig.17 (Fig.16 partly).

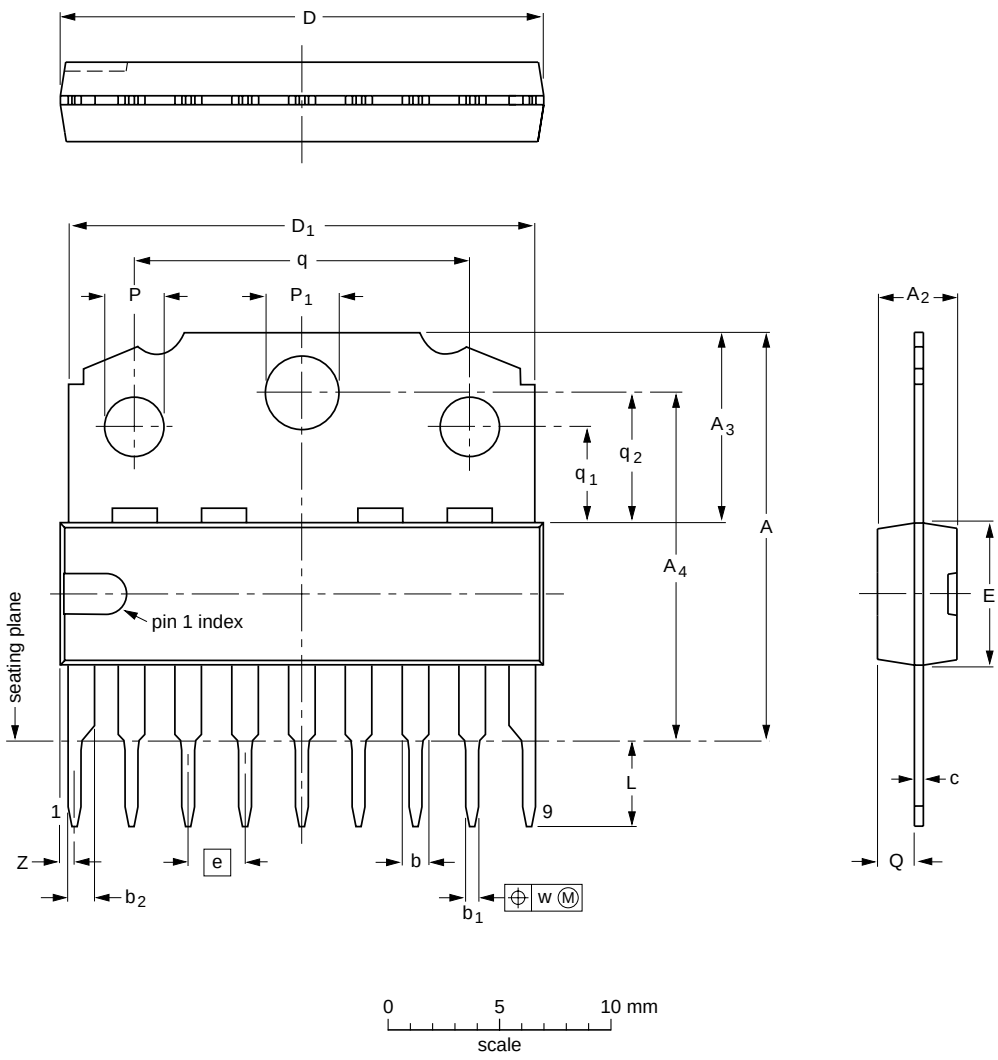


(1) belongs to power supply

Fig.20 Channel separation of the circuit of Fig.18 as a function of frequency.

PACKAGE OUTLINE

SIL9MPF: plastic single in-line medium power package with fin; 9 leads **SOT110-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_2 max.	A_3	A_4	b	b_1	b_2	c	$D^{(1)}$	D_1	$E^{(1)}$	e	L	P	P_1	Q	q	q_1	q_2	w	$Z^{(1)}$ max.
mm	18.5 17.8	3.7	8.7 8.0	15.8 15.4	1.40 1.14	0.67 0.50	1.40 1.14	0.48 0.38	21.8 21.4	21.4 20.7	6.48 6.20	2.54	3.9 3.4	2.75 2.50	3.4 3.2	1.75 1.55	15.1 14.9	4.4 4.2	5.9 5.7	0.25	1.0

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT110-1						~~92-11-17~~ 95-02-25

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.